11 Milford Lake

11.1 General Background

Milford Lake was impounded and reached conservation pool in 1967. The main threats to Milford Lake's water quality are sedimentation, nutrients, and bacterial contamination. The lake is list on the state's 2004 303(d) list for eutrophication (high) and DO (low). The KDHE is required to develop a TMDL to address the eutrophication listing.

11.1.1 Location

Milford Lake is located approximately 6.4 km (4 miles) northwest of Junction City, Kansas. The dam is located at river km 13.3 (river mile 8.3) on the Republican River. Milford Lake is the largest lake in Kansas, based on surface acreage (15,709 acres) and

Figure 11.1. Milford Lake area map with sample site locations and sample numbers.

163 shoreline miles. The watershed includes portions of Clay, Dickinson, and Riley counties, as well as the upper Republican River system. Historic water quality sample sites at Milford Lake include 3 lake, 1 outflow, and 1 inflow (Figure 11.1).

11.1.2 Authorized Purposes: Flood control, water supply, water quality, navigation, recreation, and fish and wildlife conservation.

11.1.3 Lake and Watershed Data

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1000 AF)	Surface Area (A)	Shoreline (miles)
Flood Control	1,176.2	752.9	33,000	
Multipurpose	1,144.4	372.3	16,000	163
Total		112.1		

Total watershed area: 24,880 sq miles (15,923,200 A)

Watershed ratio: 482.5 FC / 995.2 MP

Average Annual Inflow: 777,708 acre-feet
Average Annual outflow: 000 acre-feet
Average flushing rate:
Sediment inflow (measured): 47,935 acre-feet (1967 – 1994)

11.2 2005 Activities

Milford Lake was categorized as an 'ambient' lake during 2005, thus only surface samples were collected at three lake sites. Sample collections occurred from May through September 2005, while vertical profiles were recorded at the three lake sites during August. Milford Lake staff (OF-MI) providing field assistance with the WQP during 2005 included Brent Logan and Ken Wenger. Brad Myers, former OF-MI Operations Manager, provided technical insight and background knowledge on Milford Lake.

11.3 2005 Data

Comparative historic data consists of monthly (April – September) data collected from1996 through 2005.

11.3.1 Inflow
No inflow samples were collected from the Milford Lake watershed during 2005. Historically, nutrient concentrations (nitrogen and phosphorus) and contaminants are most variable at this site due to influences of runoff events within the watershed. Please see comments for lake sites below on specific parameters.

11.3.2 Lake

Milford Lake is classified as eutrophic based on total nitrogen (TN) and total phosphorus (TP) median concentrations and chlorophyll *a* values. Median TN concentrations range

from 1.1 – 1.7 mg/L (Figure 11.2), which is above EPA's proposed ecoregional nutrient criteria value of 0.44 mg/L TN. The median TN concentrations, comprising data collected between 1996 and 2004/05, are the second highest within the district. Monthly and annual variability in TN, evident at all sites, is depicted in Figure 11.3 from surface samples collected at Site 5 (upper).

Median TP concentrations range from 0.17 – 0.32 mg/L (Figure 11.3), which is above EPA's proposed ecoregional nutrient criteria value of 0.02 mg/L TP. These median concentrations are also among the highest for district lakes. Longitudinal differences in TP concentration exist between the higher inflow (Site 24) and upper lake (Site 5) in comparison to the mid-lake (Site 3) and lower-lake tower site (Site 1).

The ratio of TN:TP can be used as a surrogate to determine the dominant algal community within a waterbody. Ratios $\geq$ 20:1 are indicative of desirable algal communities, whereas ratios $\leq$ 12:1 are indicative of bloom-forming cyanobacteria (blue green algae). As would be expected, there is high monthly and annual variability in the TN:TP ratio at all sites, as is not by the range of values by site (Figure 11.4). Median TN:TP ratios at all three lake sites are < 12, indicating the lake is at risk for cyanobacteria blooms (Figure 11.4).

No chlorophyll samples were received from Milford Lake during 2005. Secchi depth measured during August indicated water clarity ranged from very limited at (0.3 m) to limited at the tower (0.8 m).

Atrazine samples were not collected during 2005. Between 1996 and 2004, median atrazine concentrations (1.2 – 1.6 ug/L) were less than EPA's drinking water maximum contaminant level of 3 ug/L (Figure 11.5). However, individual samples measured during that time period are significant enough to greatly exceed the MCL – even as recent as 2003 a sample was ~ 10X greater than the MCL. Figure 11.6 depicts individual sample concentrations measured by date at Site 24 (Republican River inflow site).

A single vertical profile was recorded on 8 August 2005. Parameters included temperature, dissolved oxygen, pH, conductivity, and turbidity. Based on this profile, the lake was chemically stratified between 5 – 6 m in depth (Figure 11.7). Thermal stratification was not strong, as there was only a 3°C temperature difference from surface to bottom at Site 2 (Figure 11.7).

11.3.3 Outflow

No outflow samples were collected from Milford Lake during 2005.

11.4 Future Activities and Recommendations

Sampling activities for 2006 will include transition to monthly 'intensive' monitoring from April through September, as well as conducting monthly vertical profiles at each of the three lake sites.

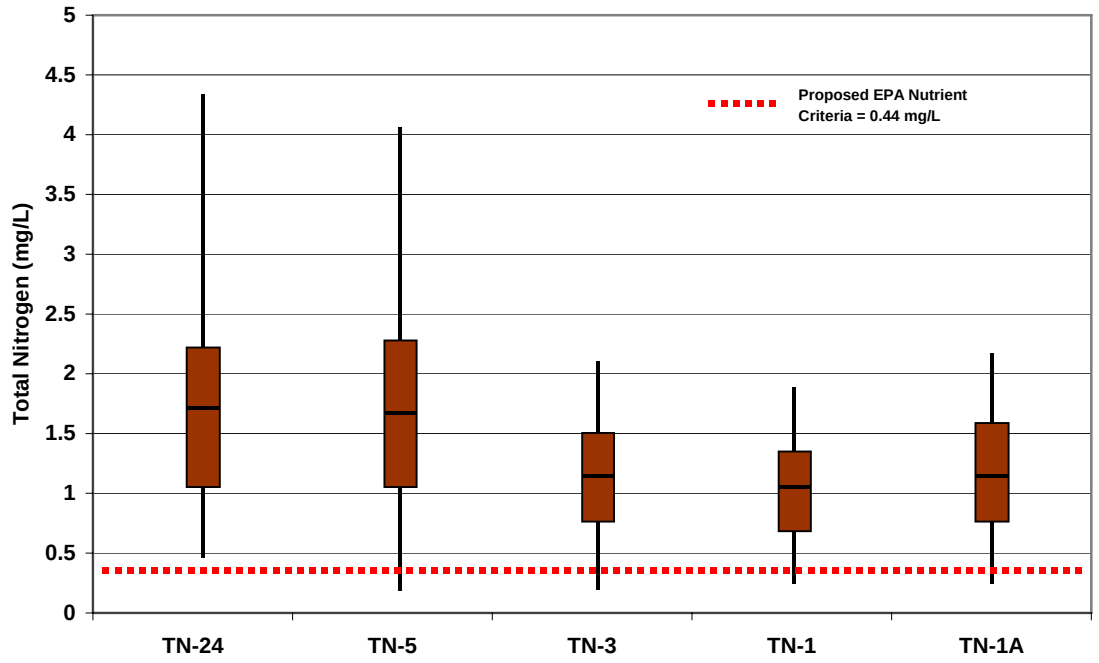

Figure 11.2. Box plots of surface water sample total nitrogen concentrations measured at lake sites from 1996 through 2005 at Milford Lake.

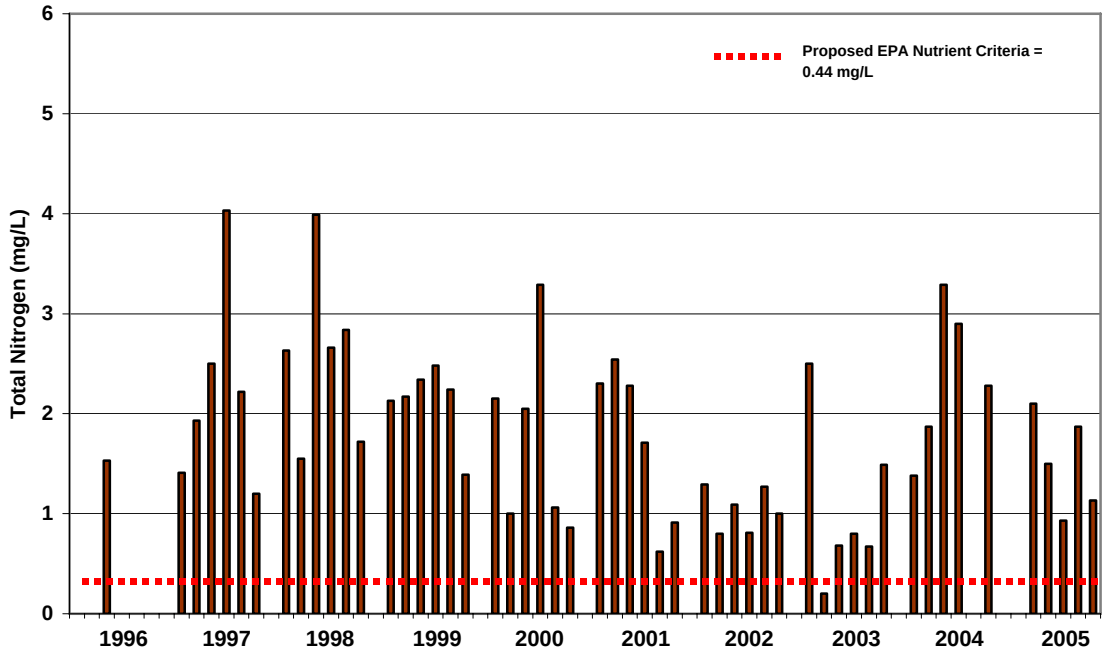

Figure 11.3. Total nitrogen concentrations by surface water sample date collected at Site 5 in Milford Lake from 1996 through 2005.

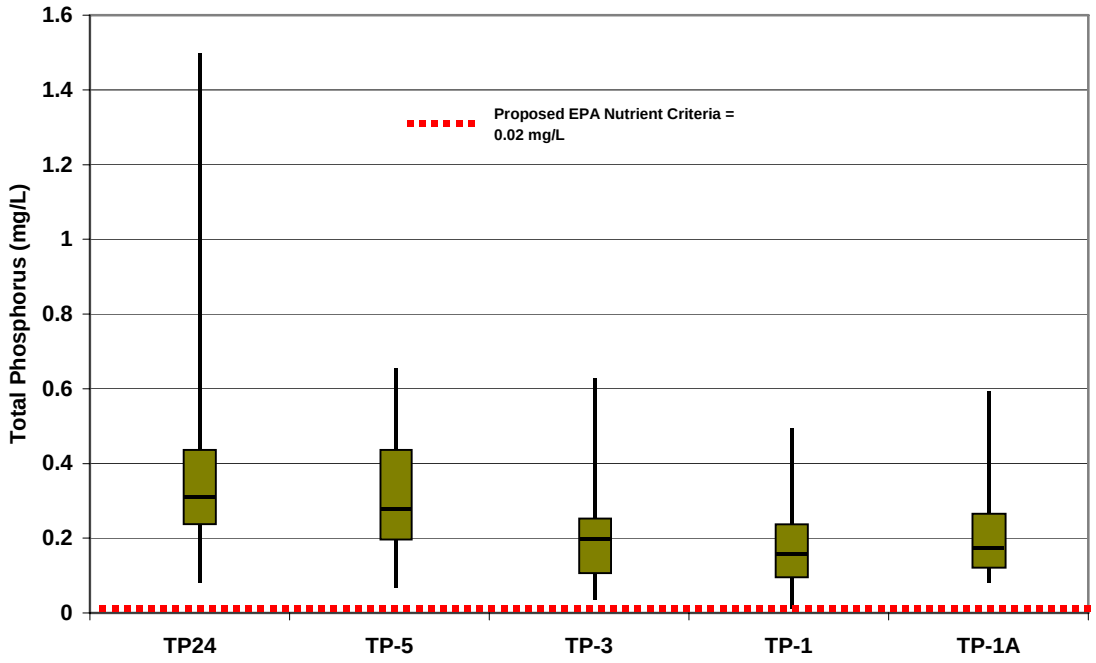

Figure 11.4. Box plots of surface water sample total phosphorus concentrations measured at lake sites from 1996 through 2005 at Milford Lake.

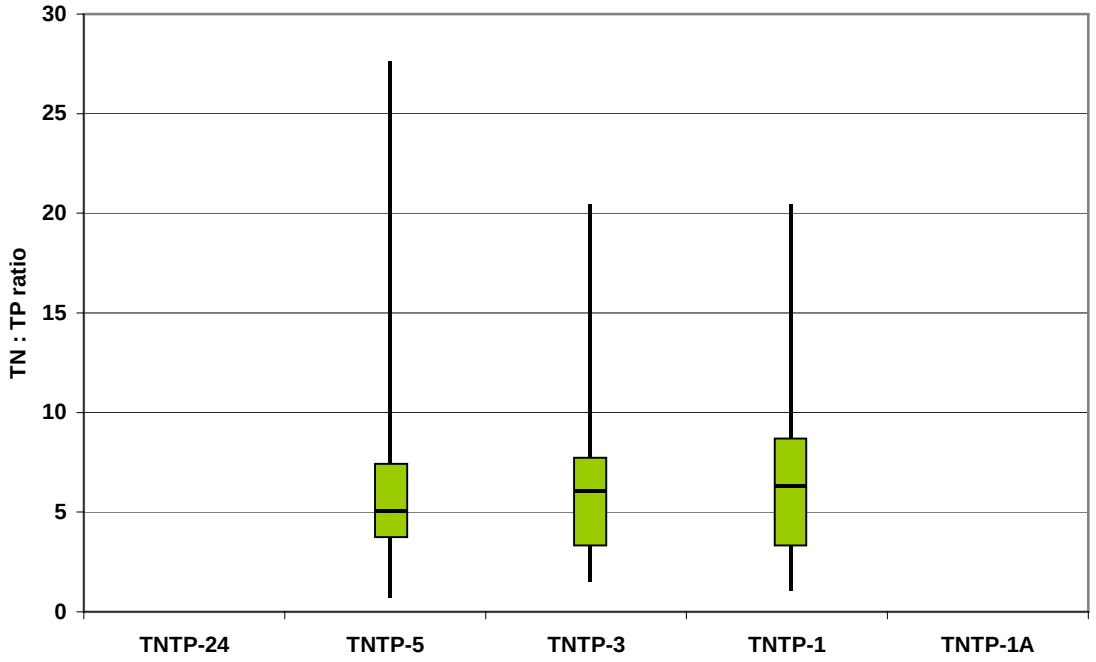

Figure 11.4. Box plots of total nitrogen : total phosphorus (TN : TP) ratio by site from 1996 through 2005 at Milford Lake.

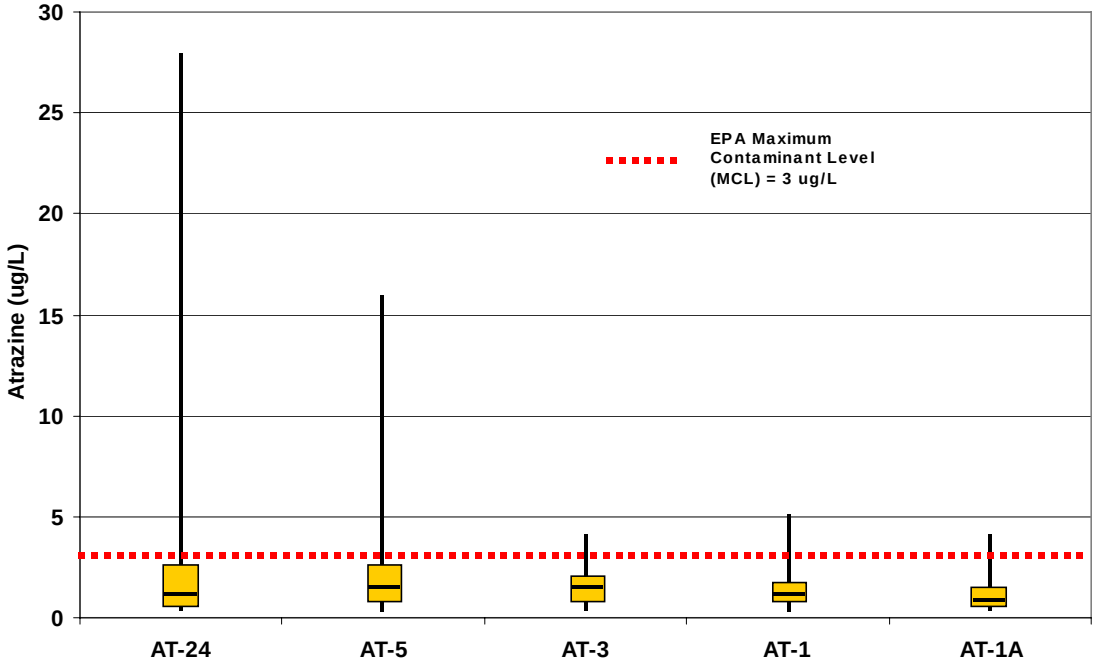

Figure 11.5. Box plots of surface water sample atrazine concentrations measured at lake sites, inflow (Site 24), and outflow (Site 1A) from 1996 through 2005 at Milford Lake.

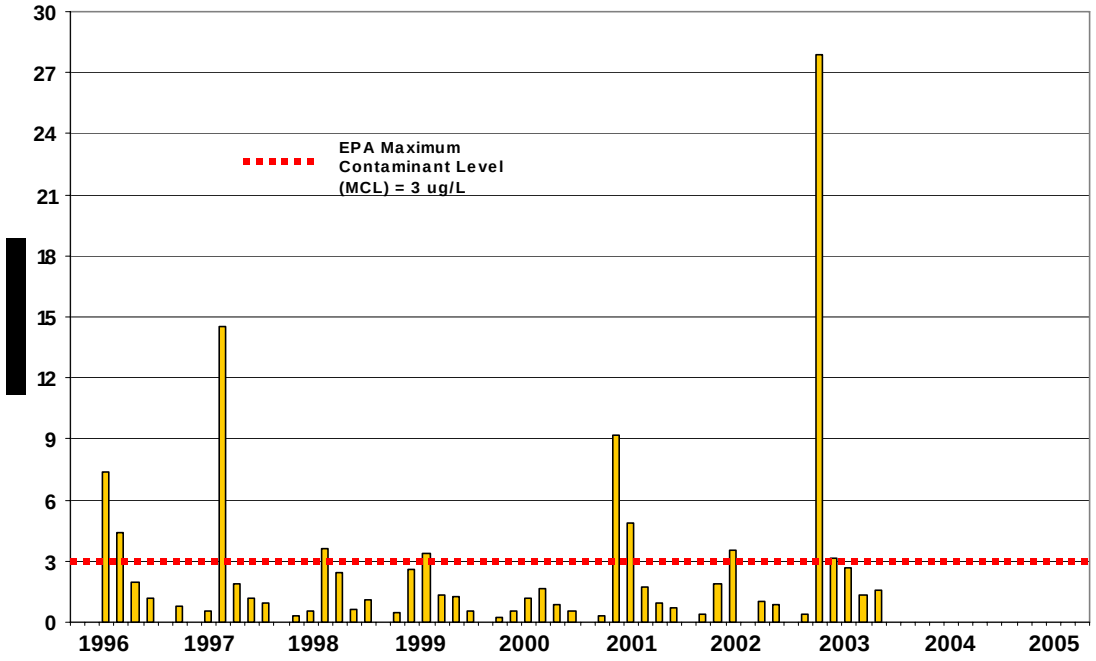

Figure 11.6. Atrazine concentrations by sample date from surface water samples collected at Site 24 (Republican River inflow) in Milford Lake from 1996 through 2005.

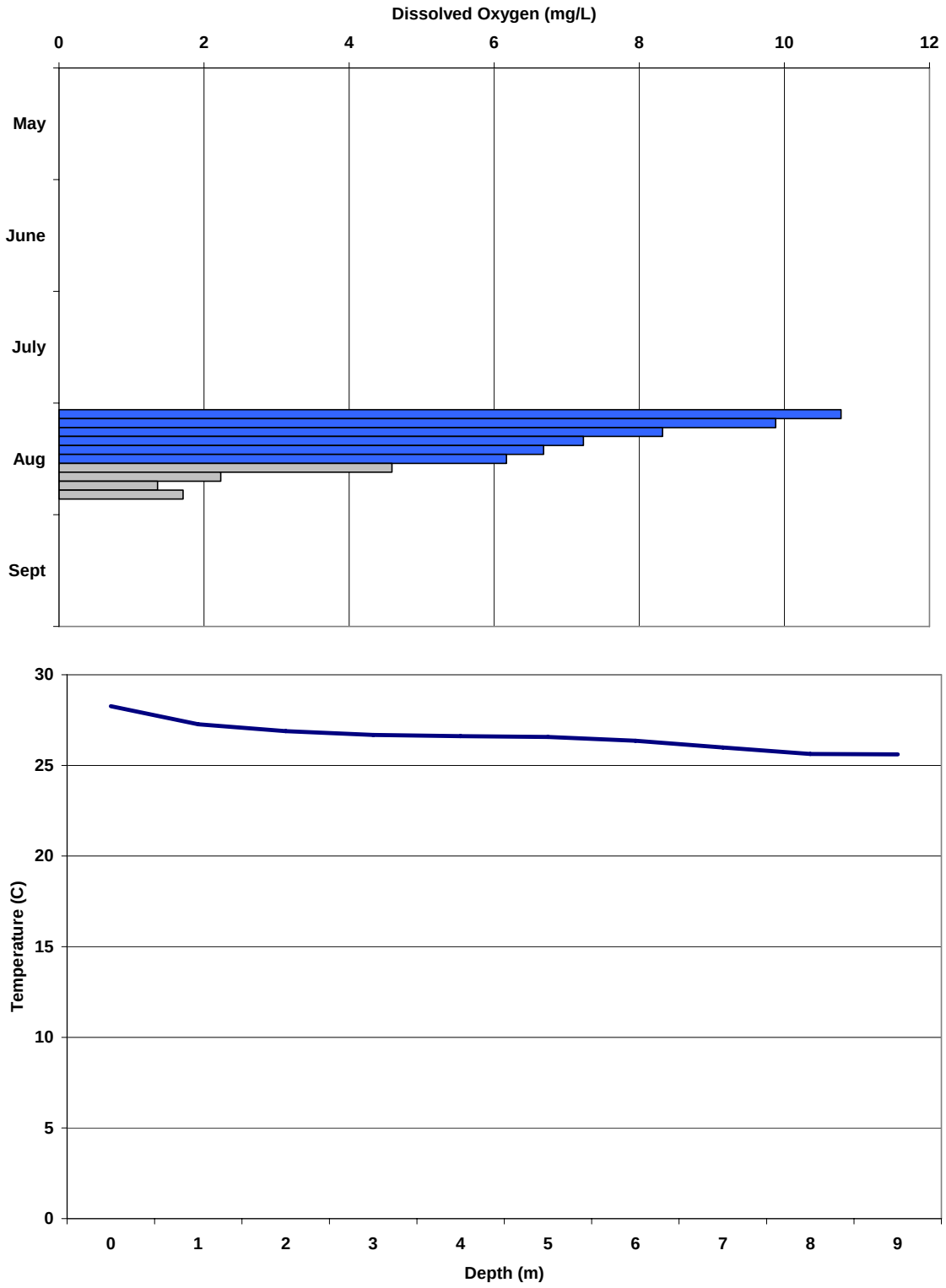

Figure 11.7. Dissolved oxygen concentration (mg/L) histogram and temperature (°C) plot from a vertical profile recorded at Site 3 on 8 August 2005 at Milford Lake.